



**ResScan**<sup>™</sup> Report Interpretation Guide

FOR CLINICAL USE ONLY V1.0 June, 2011



## **ResMed Software Support**

- Hours 5:30 AM to 5:30 PM (Pacific Time) Monday–Friday
- **Phone** +1 (800) 424-0737, Option 6
- Email TechSupportUSA@resmed.com



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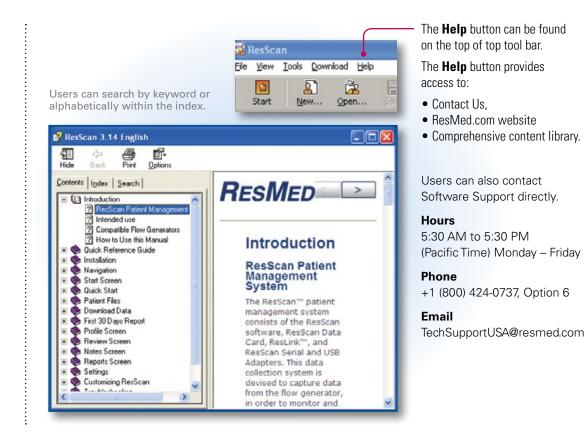
## **Purpose of This Guide**

The purpose of this guide is to demonstrate how to read and interpret treatment data with ResScan<sup>™</sup>, using examples of patients treated on S9<sup>™</sup> devices.

ResScan gives access to several different levels of information about the patient's therapy. According to preference, you can view this information in ResScan (see example below) or in a PDF report (examples shown on the following pages).



## **Help is Available**



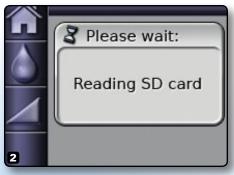
**Getting Started** 

# Getting Started with ResScan

## **Copy Data from PAP Device**



Insert card (if not already in device)



The following message is briefly displayed "Reading SD card"



Remove card



Transfer data on card to software program





## **Types of Available Data**

- Summary Data
  - Usage
  - Efficacy (eg, AHI, pressure, leak)

## **Detailed Data**

• Nightly profile data

## High Resolution Data

- Higher data sampling rate
- Flow data: Overall airflow breath by breath

## Oximetry Data (available with S9 Oximeter modules)

- Oxygen desaturation index (ODI)
- Blood oxygen saturation (SpO<sub>2</sub>)
- Pulse rate

ResMed devices offer various types of data to monitor patients' usage and therapy efficacy. The types of data available vary with device platforms, device models and acquisition accessories used.

Value-end devices provide essential patient usage information such as daily summary data. Premium devices such as AutoSet<sup>™</sup> and Elite<sup>™</sup> support additional data capabilities.



# **Data Types Available by Device**

Data Storage							
S9 Series	Escape / Escape Auto	Elite	AutoSet	VPAP Auto	VPAP S	VPAP ST	VPAP Adapt
Sleep report on screen (365 sessions)	•	•	•	•	•	•	•
Compliance and summary data on device (365 sessions)	•	•	•	•	•	•	•
Compliance and summary data on SD card (365 sessions)	•	•	•	•	•	•	•
Detailed data on SD card (30 sessions)		•	•	•	•	•	•
High resolution flow data on SD card (7 sessions)		•	•	•	•	•	•
High resolution pressure data on SD card (7 sessions)				•	•	•	•
ResScan Display							
S9 Series	Escape / Escape Auto	Elite	AutoSet	VPAP Auto	VPAP S	VPAP ST	VPAP Adapt
Statisitics	•	•	•	•	•	•	•
Summary Graphs	•	•	•	•	•	•	•
Detailed Graphs		•	•	•	•	•	•
Oximetry Statistics*		•	•	•	•	•	•
Oximetry Graphs*		•	•	•	•	•	•

\*Only available when the S9 oximeter module is used with device.

## Launch ResScan

Install the program from your browser or CD, then launch the program from the newly created desktop shortcut or from Programs.

Contact Software Support to receive proper installation instructions.

**Software Support** 

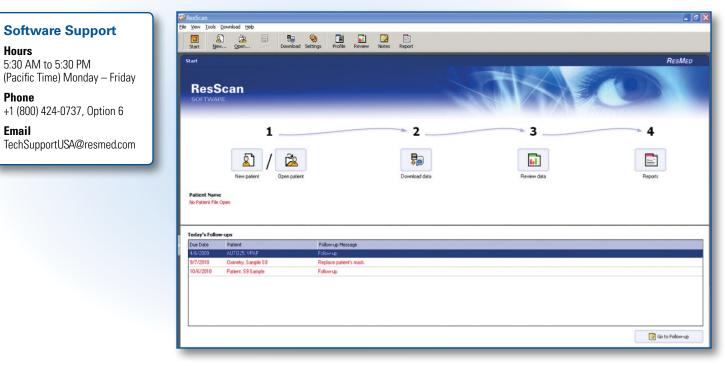
+1 (800) 424-0737, Option 6

5:30 AM to 5:30 PM

Hours

Phone

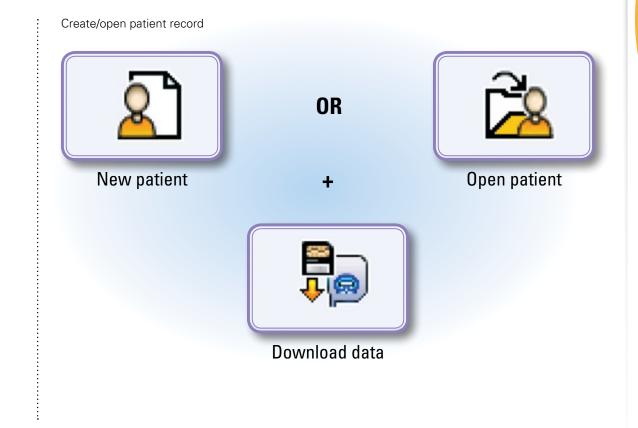
Email



# Data Card Download Option 1—Quick Start Enabled

Device Detecte Select a patient and click	ed - 59 EIITe : either Create Report or Vi	iew Data to cont		ve all fields blank to create an anonymous re	port.
&Search &Cre	ate Patient				Create/open patient record
Patient name, ID, o 22101468661	r flow generator serial:		Search		
Family Name	Given Names	ID	Address	Group	
S9Elite	4BetterSleep1			Default	
Colort Deport			Select Data Type to D	ownload	
Select Report	•				

# Data Card Download Option 2—Quick Start Disabled





# **Create New Patient Record**

ResScan	New Patient	×
SOFTWARE	Patient Information     Title     Mr     Family Name     Patient     Given Names     Sample     Patient ID	
Select <b>New patient</b> from the ResScan home page.	Gender V Male Female Day Month Year Date of Birth 24 May V 1953 I Age 57 Insert	
	Patient Group Default	
Fill in required information and click <b>Save</b> . —	Required fields are in bold Cancel	

# **Open a Patient Record**

ResScan SOFTWARE 1 New patient Deen patient

Select **Open patient** from the ResScan home page to open a patient file.

Highlight the patient's name and click **Open**.

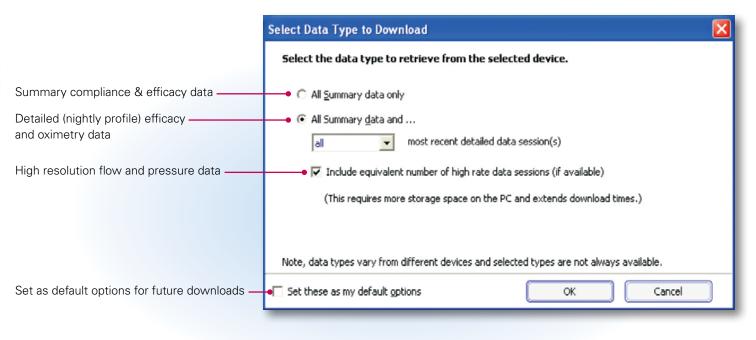
Examples	•			4 file(s) using 3
	_		1	
Patient List Family Name	Given Names	ID	Address	
& AUTO25	VPAP	10	10000	
& AutoSet II AMER	AutoSet EasyBreathe (Full	07891	1 Elizabeth Macarthur Drive Bella Vista NSW	
& AutoSet II AMER	AutoSet EasyBreathe (Set		1 Elizabeth Macarthur Drive Bella Vista NSW	
& AutoSet II AMER	CPAP EasyBreathe (Full Ti	07893	1 Elizabeth Macarthur Drive Bella Vista NSW	
& AutoSet Spirit	No Resink	SX116-0311		
& Elite II AMER	CPAP EasyBreathe (Full Ti		1 Elizabeth Macarthur Drive Bella Vista NSW	
Scope	58			
& Example	AC52	100001	5 Example Rd Sleepburg CSR	
& Example	Malibu	01502004	1389 Logan Road Mt Gravatt Central OLD	
& Example	S8 AutoSet Vantage II	1103040	1 Hardner Road Mt Waverley Victoria	
& Example	S8 Escape II	07896	1 Elizabeth Macarthur Drive Bella Vista NSW	
& Example	S8AutoSet ResLink	12502004	1 Elizabeth Macarthur Drive Bella Vista NSW	
& Example	VPAP Auto	07894	1 Elizabeth Macarthur Drive Bella Vista NSW	
& Example	VPAP Auto 25	07895	1 Elizabeth Macarthur Drive Bella Vista NSW	
& New-SmartCard-Reader	Malibu-Test			
& Old-SmartCard-Reader	Malibu-Test			
& Patient	Test			
& Patient	Test 2			
& Smart	Card			
<				



# Download Data—Select Data Type

Patient	S9Patient, Test	
Device	S9 AutoSet on SD card / US8 flash disk on Drive F:	Select
Data	All available data	Select
Typical Download Times	Typical download times for the selected device are: Summary Data (90 Sessions): 0 mins 10 secs Detailed Data (1 Sessions): 0 mins 15 secs	
	🕞 Start Download	Close

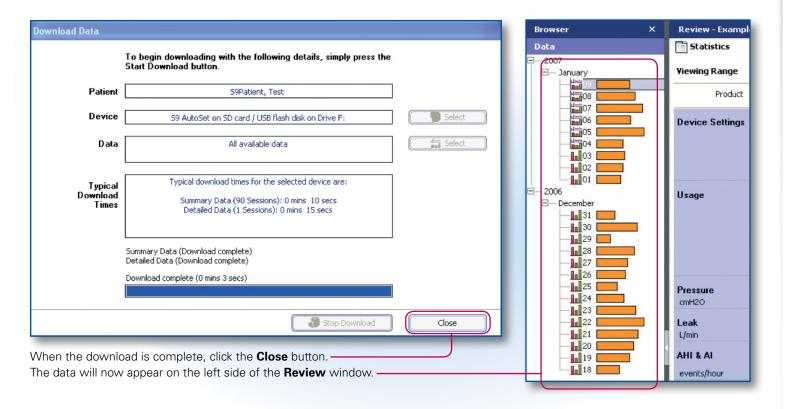
## **Download Options**



# Download Data—Start Download

Patient	S9Patient, Test	
Device [	S9 AutoSet on SD card / USB flash disk on Drive F:	Select
Data	All available data	Select
Typical Download Times	Typical download times for the selected device are: Summary Data (90 Sessions): 0 mins 10 secs Detailed Data (1 Sessions): 0 mins 15 secs	

## **Download Complete**



## **ResScan**

## First 30 Days Compliance Reporting

 Software automatically identifies first 30-day date range when patient meets Medicare compliance criteria\*

## CMS reimbursement guideline

- Use of PAP ≥ 4 hours per night
- 70% of nights during a consecutive 30-day period anytime during the first three months of initial usage

\*Medicare adherence to therapy is defined as use of PAP  $\ge 4$  hours per night on 70% of nights during a consecutive 30-day period anytime during the first three months of initial usage. - CMS, LCD for PAP Devices for the Treatment of OSA, Jurisdiction A, B, C, D, updated April 1, 2010

# **First 30 Days Viewing Range**

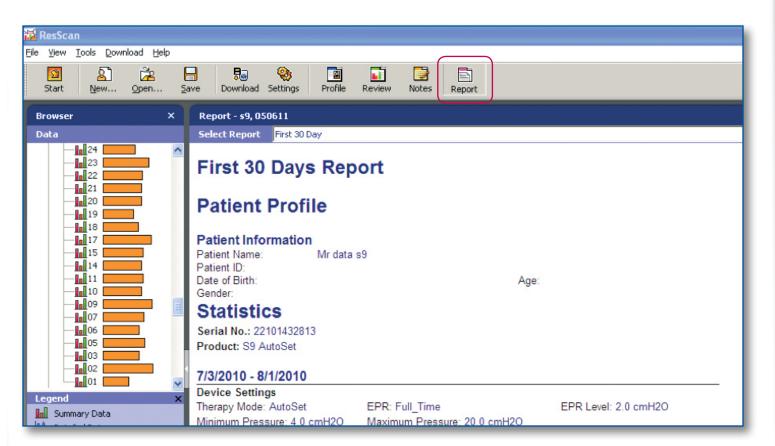
Browser ×	Review - Patient,	Compliant
Data	<b>Statistics</b>	Summary Graphs
	Viewing Range	1 Day or 3/1
15	Product	First 30 Days toSet
14 13 13 12 12 12 12 12 12 12 12 12 12 12 12 12	Usage	1 Weeks 2 Weeks 3 Weeks
		1 Month 2 Months v usage: (hrs/day of used days)
		Average daily usage: (total hrs/total days)

When First 30 Days is chosen, software will automatically select the first 30 days of compliance per Medicare guidelines.

# **First 30 Days Statistics**

Statistics	Summary Graphs	De ∆4	tailed Graphs	📮 Oxim	netry Statistics	Devi 🖸 Devi
Viewing Range	irst 30 Days 🔹 or	8/20/2008	<b>to</b> 9/18/20	08		
Product	AutoSet II AMER		Serial No.	2008	0238401	
Usage	Total hours used: (hrs:min)	198:08	Used Days >= 4 hrs Used Days < 4 hrs		days days	
	Median daily usage: (hrs/day of used days)	7:42	Days not used: Total days:		days days	
	Average daily usage: (total hrs/total days)	6:36	% Used Days >= 4 hrs	83	%	
Leak L/min	Median:	0.0	95th Percentile:	13.2	Maximum:	24.0
AHI & AI	Apnea index:	1.1	Hypopnea index:	6.3	AHI:	7.3
events/hour					% Time in Apnea:	0.3

## **Compliance Report Ready to Print**



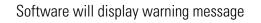
# Sample First 30 Days Report

## First 30 Days Report

## **Patient Profile**

i unenti i io			
Patient Informati	on		
Patient Name: Patient ID: Date of Birth: Gender:	Mr Compliant Patient 01011950 1 January 1950 Male	Age: 61	
Statistics			
Serial No.: 22091401	1022		
Product: S9 AutoSet			
2/3/2010 - 3/4/201	0		Consecutive 30-day
Device Settings			period when compliance
Therapy Mode: AutoS	EPR Level: 2.0 cmH2O	Minimum Pressure: 4.0 cmH2O	was achieved.
Maximum Pressure: 2 cmH2O	20.0		
Usage			
Used Days >= 4 hrs :	28 Used Days < 4 hrs : 1	% Used Days >= 4 hrs : 93	
Days not used: 1	Total days: 30	Median daily usage: 7:02	
Total hours used: 199	.36 Average daily usage: 6:39	)	
CMS Compliance			
Compliance: 93.3%	CMS Compliant: Yes		and compliance criteria met.

# **Compliance Not Met**





ResScan			- @ 🛛
e <u>V</u> iew <u>T</u> ools <u>D</u> ownload <u>H</u> elp			
Start New Open	Save Download Settings Profile	Review Notes Report	
Browser X	Report - 59-CPL2, 59 AutoSet		ResMed ×
Data	Select Report Usage Compliance, •	🗾 🎫 Customize 🏻 🍟	Add Comment 🛛 📇 Print 📑 Email 📑 Save
2009	Patient ID: Date of Birth: Gender: <b>Statistics</b> Serial No.: 22091321033 Product: S9 Autoset-CPL1 12/6/2009 - 12/6/2009	utoSet S9-CPL2 Age	4 
	Device Settings Therapy Mode: AutoSet	EPR: Full Time	EPR Level: 3.0 cmH2O
	Minimum Pressure: 7.4 cmH20	Maximum Pressure: 20.0 cmH20	Erik Level, 3.0 chili20
Legend X		maximum r ressure. 20.0 cm i20	
Summary Data	Used Days >= 4 hrs : 1	Used Days < 4 hrs : 0	% Used Days >= 4 hrs : 100
A Detailed Data	Days not used: 0	Total days: 1	Median daily usage: 5:16
Summary and Detailed Data	Total hours used: 5:16	Average daily usage: 5:16	
Reports	CMS Compliance Compliance: 0.0%	CMS Compliant: No	

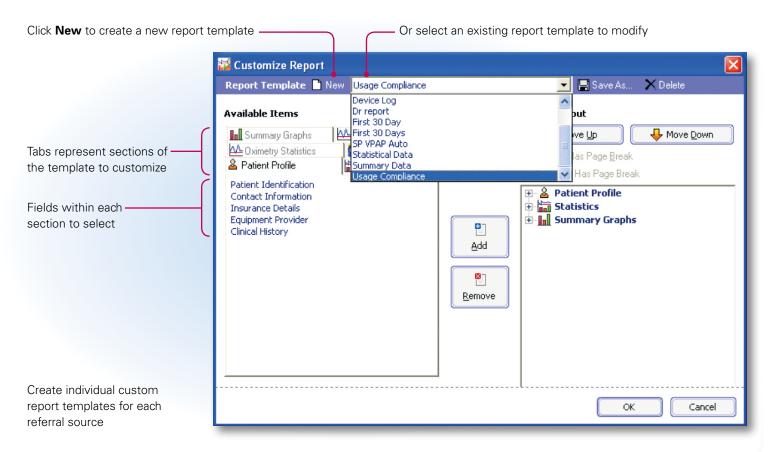
The Usage Compliance report is shown when patient does not meet compliance criteria

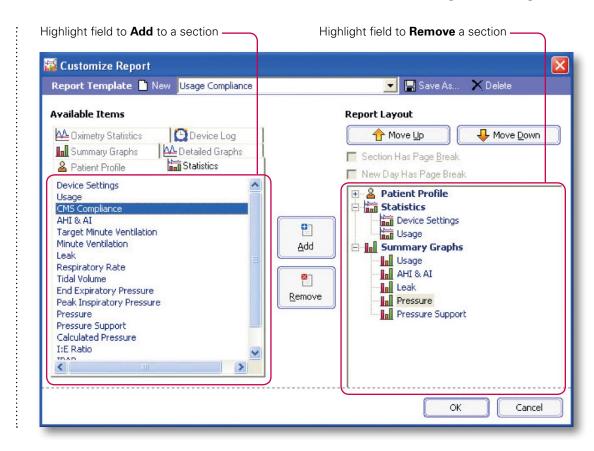
There are several report templates automatically installed with the ResScan software. Users are able to customize these default templates, as well as create a new report template.

The default report templates are:

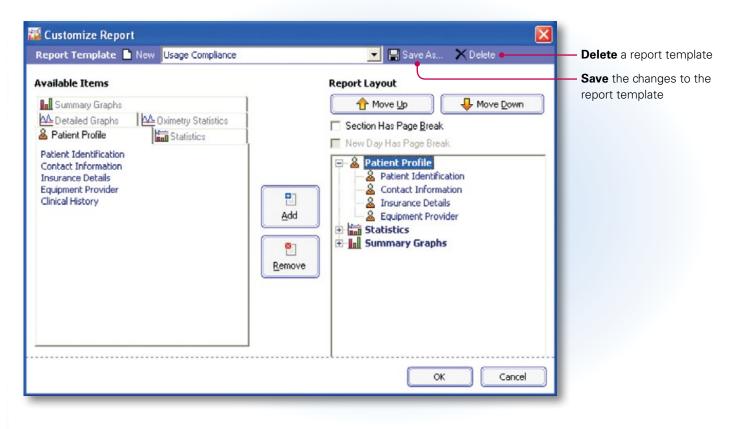
- All Available Data
- Detailed Data
- First 30 Days Report
- Statistical Data
- Summary Data
- Usage Compliance Report

# **Customize Existing or Create New Template**





Report Template 🗋 New Usage Compliance	🔀 🔄 🔄 Save As 🗙 Delete	
Available Items  Summary Graphs Coximetry Statistics Patient Profile Patient Identification Contact Information Insurance Details Equipment Provider Clinical History	Report Layout  Move Up Move Down  Section Has Page Break  New Day Has Page Break  New Day Has Page Break  Report Statistics  Summary Graphs  Move Down	<ul> <li>Move section or field order within the report</li> <li>Uncheck box to remove page break in the report (reduces number of pages in report)</li> </ul>
	OK Cancel	



ResScan

Save report template? You have made modifications to the current report template.



No

Would you like to save you modifications for the current report template?

Click,

- Yes, to save the template,
- No, to ignore changes and close the dialog.

Will be prompted to save or discard any changes made to the template



Yes

# **ResScan Interpretation**

Provides clinical data analysis information to users

## **Statistical Data: Therapy Overview**

This is an example from a ResScan statistics report. The same type of data is presented in ResScan.

The numbers 1–4 on the left show the recommended order in which the data should be analyzed.

Statistics Serial No.: 22102499692			
Product: S9 VPAP Auto			Device type and serial number
12/28/2010 - 2/21/2011			Range of dates selected
Device Settings Therapy Mode: VAUTO Max IPAP: 20.0 cmH2O	Pressure Support: 4.0 cmH2O	Min EPAP: 4.0 cmH2O	Device mode and settings
Usage Used Days >= 4 hrs : 18 Days not used: 38 Total hours used: 118.22	Used Days < 4 hrs : 0 Total days: 56 Average daily usage: 2.06	% Used Days >= 4 hrs : 32 Median daily usage: 6:42	Compliance Data
Leak - L/min Median: 1.8	95th Percentile: 7.8	Maximum: 18.0	Unintentional leak
AHI & AI - Events/hr Apnea index: 0.5 Central: 0.0	AHI: 0.8 Unknown: 0.0	Obstructive: 0.4 Hypopnea index: 0.3	AHI, AI, CAI, OAI, HI
IPAP - cmH2O Median: 14.2	95th Percentile: 17.6	Maximum: 19.3	Pressure
EPAP - cmH2O Median: 10.2	95th Percentile: 13.7	Maximum: 15.3	Tressure
Minute Ventilation - L/min Median: 9.1	95th Percentile: 11.9	Maximum: 24.3	
Tidal Volume - mL Median: 540	95th Percentile: 700	Maximum: 1280	
Respiratory Rate - breaths/min Median: 16 % Spontaneous cycled breaths: 99	95th Percentile: 19	Maximum: 25	
I:E Ratio Median: 1:1.75	95th Percentile: 1:1.42	Maximum: 1.1.25	

#### DEFINITIONS

**Leak:** This refers to unintentional leak, which is the leak value after deduction of the intentional mask leak.

**Maximum Value:** The highest value reached during treatment.

**95th percentile value:** The value exceeded during the selected range for 5% of the time. This value excludes very high leak values which are not always representative of actual clinical experience.

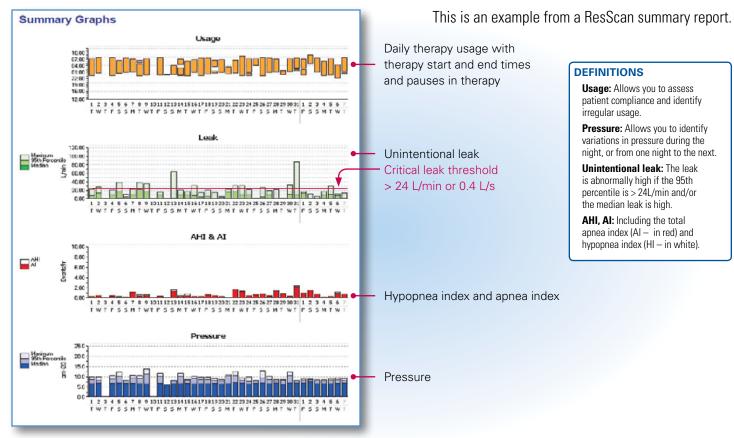
**Median Value:** The median value recorded during the selected range. This value minimizes the impact of extreme values and is a better representation of the group of values as a whole.

**AHI, AI and HI:** Number of events per hour according to the event type

**OAI:** Obstructive apnea index (upper airway closed)

**CAI:** Central apnea index (upper airway open)

**Unknown AI:** Index of undetermined apneas with large unintentional leaks > 0.5 L/s (30 L/min).



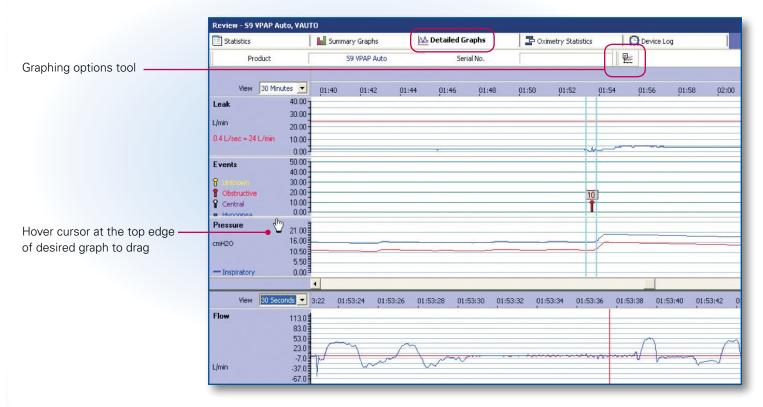
## Summary data: How the Therapy Changed During the Time Period

# **Select Detailed Graphs**

Browser X	Review - 59 AutoSet, Webinar RESMED ×				
	Statistics	Graphs 🗠 Detailed Graphs	Coximetry Statistics		
Browser X Data □ - 2009 □ - December 		Graphs Let Detailed Graphs Serial No.	Cometry Statistics	HESMED ×	

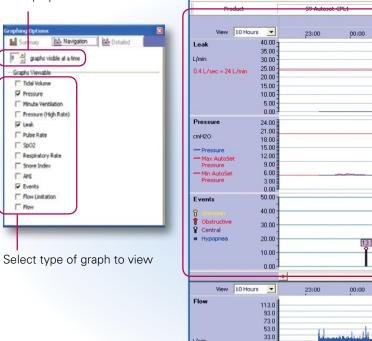
## **Detailed Graphs—Split Screen**

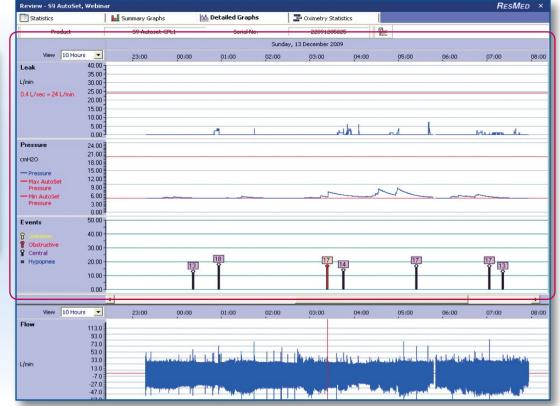
## Available with Elite, AutoSet and bilevel therapy devices



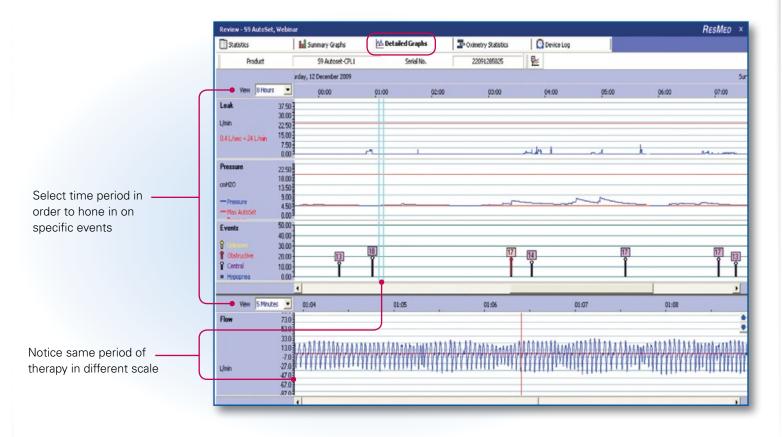
# **Detailed Graphing Options—Select Traces**

Specify number of graphs to display





# **Detailed Graphing Options—Time Period**



# **Detailed Data Graphs**

#### Therapy pressure

Pressure settings indicated by red threshold lines

#### **Unintentional leak**

Leak threshold setting indicated by red line

#### Events

Type of event (eg, central apnea) and duration of event in seconds (number at top of event line)

AHI per hour Resets each hour



Interpretation

## **Detailed Data—Leak**

## Single night

- Looking for leak to be below 24 L/min over the course of the night
- High leak may be affecting the accuracy of the data

Review - 59 Test, 9	SumNDet Data	1					
<b>Statistics</b>		Summary Gra	phs	🕰 Detailed Graphs	20	ximetry Statistics	
Viewing Range	1 Day	-	or	💌 to		•	
Product		59 Autoset		 Serial No.	22	091285015	
<b>Leak</b> L/min		Median:		3.6 95th Percentile:	26.4	Maximum:	40.8

Periods of leak > 24 L/min during the night

24 L/min leak threshold line View 10 Hours -01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 10:00 09:00 Leak 37.50 30.00 L/min 22.50 0.4 L/sec = 24 L/min 15.00 7.50 0.00

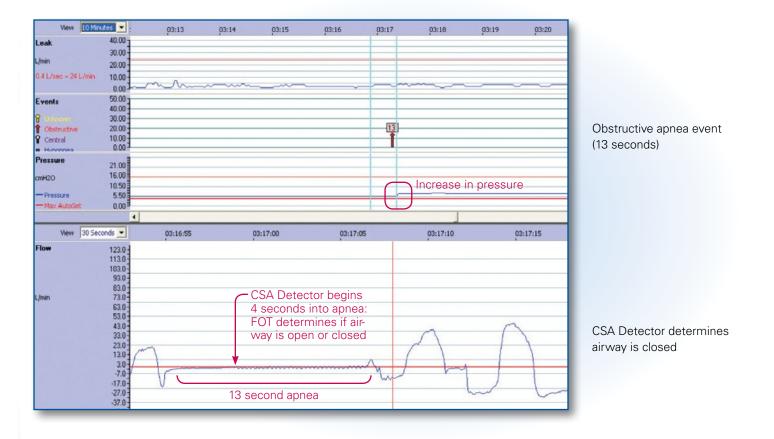
# **Detailed Data**—**Pressure**

## Pressure

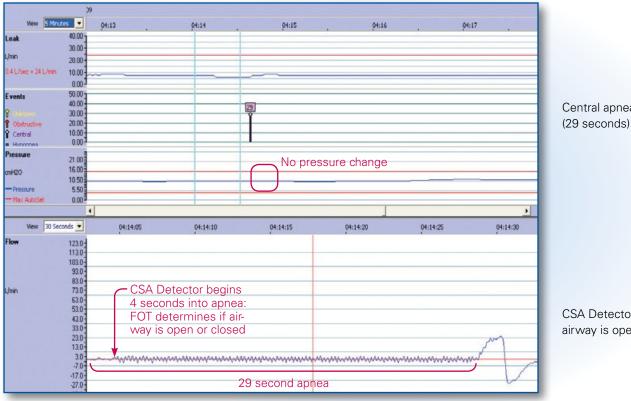
- Review pressure increases in response to events
- Once the airway remains patent, the pressure begins to drop

Review - 59 Au	toSet, AutoSe	et EPR 2				<b>R</b> esMed >	×
Statistics		Summary Graphs	🗠 Detailed Graphs	P Oximetry Statistics	Device Log		
Produ	uct [	S9 AutoSet	Serial No.	22091401022			
				Wednesday, 17 March 2010	)		
View 5	Minutes 💌	01:	41 01	1:42	01:43	01:44 01	1:4
Pressure	24.00						Η
cmH2O	22.00						
- Pressure	20.00 18.00						
Max AutoSet Pressure	16.00						
-Min AutoSet	14.00 12.00						
Pressure	10.00						-
	8.00 6.00						
	4.00						-
	2.00 0.00						
Events	50.00						4
🖁 Unknown	45.00 -						
1 Obstructive	40.00 -						
<ul> <li>Central</li> <li>Hypopnea</li> </ul>	35.00 -			30	]		
	30.00 - 25.00 -			Ī			
	20.00 -						
	20.00						

## **Detailed Data—Obstructive Apnea**



## **Detailed Data—Central Apnea**

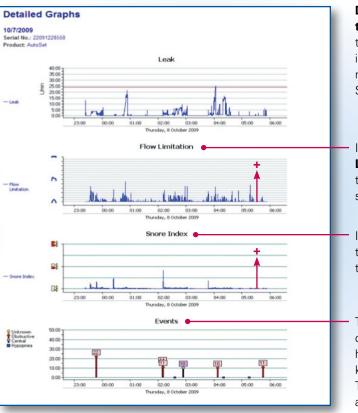


Central apnea event

CSA Detector determines airway is open

## **Detailed Data for a Single Night: To Get to the Heart of the Therapy**

Note: The user can configure the layout of the graphs when selecting a report.



Detailed data is available on the past 30 days: Leak, event types, flow limitation, snore index, events, pressure and minute ventilation, as well as  $SpO_2$  and pulse rate.

In the inspiratory **Flow Limitation** graph, the taller the bar, the more severe the limitation.

In the **Snore Index** graph, the taller the bar, the more severe the snore.

The event types (obstructive/ central/unknown apneas and hypopneas) are shown in the key beside the **Events** graph. The duration of the apneas are indicated on the event bar.

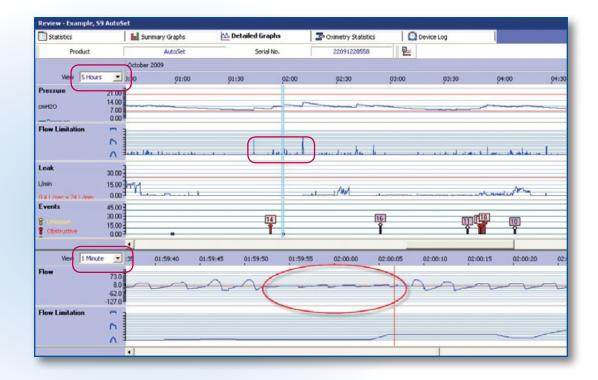


# **High Resolution Data for a Single Night: Flow Curve**

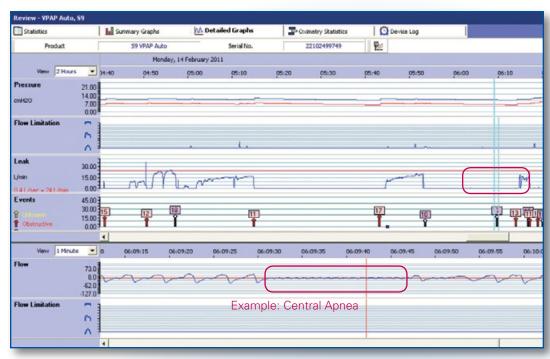
The patient's flow curve is available for the last 7 days. Here are some examples of flow curves in relation to respiratory events.

On this screen, the upper and lower windows are displayed with 2 different time scales (customizable).

In the this example, the circles indicate time scales of 5 hours (upper window) and 1 minute (lower window respectively.)



# High Resolution Data for a Single Night: Flow Curve



The events are color-coded according to type.

#### **Central Apnea:**

Apnea with an open airway

#### **Obstructive Apnea:**

Apnea with a closed airway

#### **Unknown Apnea:**

Apnea that cannot be defined because it occurs in the presence of high unintentional leak (> 0.5 L/s or 30 L/min)

#### Hypopnea:

Hypopnea associated with flow limitation

The number above the event indicates apnea duration in seconds

Flow curves are available if downloaded by selecting the "Include equivalent number of high rate data sessions" check box.

You can make this your default option.

# Oximetry



# **Oximetry Data**

- Available with oximeter modules
- Downloaded with Detailed Data
- Beneficial to use for very difficult-to-treat patients in evaluating the efficacy of their therapy
- SpO<sub>2</sub>: Arterial oxygen saturation
- ODI: Oxygen desaturation index
  - Number of desaturation events/hour
  - Desaturation event triggered when  $SpO_2$  drops below threshold (default  $\ge 4$  %)

ODI Detection Parameters			
SPO2 decline threshold	4	%	[3 - 4]

• Pulse rate: Heart rate per minute



## **Detailed Data Graphs—Oximetry**

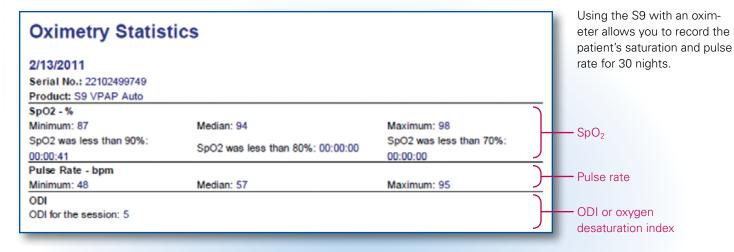


Correlate events, therapy and desaturation values in a single application

# **Oximetry Statistics—On Screen**

Statistics	In Summary Graphs	A Det	ailed Graphs	- Oximetry St	atistics	Device Log
Product	59 AutoSet		Serial No.	2210113757	7	
Pulse Rate bpm	Minimum:	50	Median:	63	Maximum:	105
ODI	ODI for the session:	10				
Sp02 %	SpO2 was less than SpO2 was less than SpO2 was less than	90 80 70	% for 00:00:02 h % for 00:00:00 h % for 00:00:00 h	nh:mm:ss		
	Minimum:	89	Median:	94	Maximum:	99

## **Detailed Data with S9 Oximetry**



Oxygen desaturation index **(ODI)**: Represents the average number of desaturations per hour.

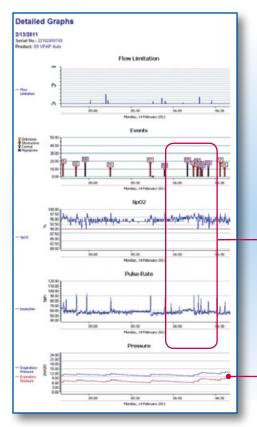
The desaturation percentage can be set by the user in the Options window in ResScan (default is 4%).

Note: Oximetry data is recorded while in therapy mode and when the patient is breathing into the mask.



SpO<sub>2</sub> and pulse rate instantaneous values displayed on the S9 screen **Oximetry** 

## **Detailed data with S9 oximetry**



The **SpO<sub>2</sub>** and **Pulse Rate** graphs are displayed alongside the other graphs (inspiratory flow limitation, events, pressure, flow, etc). This allows you to link the events to the level of desaturation.

 In this example, the obstructive apneas cause a decrease in the SpO<sub>2</sub> and an increase in the pulse rate.

- The device **increases the pressure** after the obstructive events (apnea and flow limitation).

**Oximetry** 

# **Notes and Device Log**

Save Download Settings Profile Review Notes Report	
Notes - 59 VPAP Auto, VAUTO	
New Save X Delete Sprint View All	
🗈 👻 Created 📤 User Note	
– 🗊 😻 3/18/2011 MyHongV Call patient to download card • – – Add note here	
We Detailed Graphs The Device Log, shown	non
Detailed Graphs Cximetry Statistics Device Log the tool bar, is only used	
to the Stellar™ devices whi support ventilation.	ch
Serial No.	

Oximetry

# **Case Studies**

## **Case Study 1:** High leak–mouth leaks suspected

Patient treated on S9 AutoSet with a nasal mask. He is complaining of a dry mouth.

- The average usage is excellent: 5 hours 49 min.
- **2** The level of unintentional leak is high:
  - 95<sup>th</sup> percentile leak > 24 L/min
  - median leak = 0 L/min.
- 3 The AHI is very high (32.4). There is also an unknown apnea index (4.1). This index is a further sign of high leak concurrent with apneas (leak > 30 L/min).
- ④ The treatment pressure at the 95<sup>th</sup> percentile is 19.8 cm H<sub>2</sub>O with a maximum pressure setting of 19.9 cm H<sub>2</sub>O.

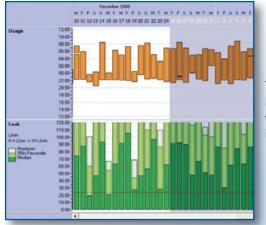
In the presence of a high level of unintentional leak, the AHI value cannot be analyzed correctly. First, you need to solve the leak issue.

Statistics		Summary Graphs	Del	tailed Graphs	P Oxi	metry Statistics	
Viewing Range	1 Day	• or	5/ 4/2011	💌 to 🗾 5/	4/2011		
Product		59 AutoSet		Serial No.	221	11051808	
Device Settings		Therapy Mode:	AutoSet	Minimum Pressure:	10.0	mH20	
				Maximum Pressure:	20.0	mH2O	
				EPR:	Full_Time		
				EPR Level:	3.0	mH20	
Usage 1		Total hours used:	5:49	Used Days >= 4 hrs		1 days	
_		(hrs:min)		Used Days < 4 hrs		0 days	
		Median daily usage:	5:49	Days not used:		0 days	
		(hrs/day of used days)		Total days:		1 days	
		Average daily usage: (total hrs/total days)	5:49	% Used Days >= 4	hrs 10	0 %	
Leak 2		Median:	0.0	95th Percentile:	34.8	Maximum:	157.2
АНІ & АІ 3		Apnea index:	30.4	Hypopnea index:	2.0	AHI:	32.4
events/hour		Obstructive:	26.1			% Time in Apnea:	
		Central:	0.1				
		Unknown:	4.1				
Pressure 4		Median:	19.2	95th Percentile:	19.8	Maximum:	19.9

#### ResMed devices calculate unintentional leak:

Unintentional leak = Total leak - Intentional leak from mask CO<sub>2</sub> washout You have to set the mask type (default is *nasal*).





The summary data shows variable leak levels over the first few days, with a marked increase in leaks in the days following.

This detailed leak graph shows significant leak episodes in some periods and none at all in other periods.



# Case Study 1:

# Suggested Solution

Adding a humidifier can help to reduce nasal resistance and decrease mouth leak.

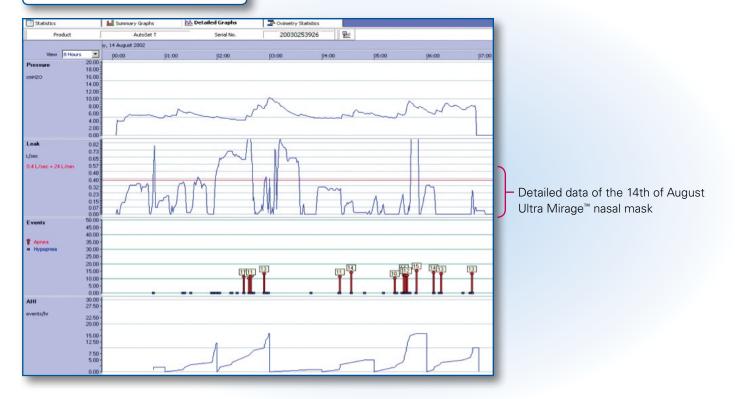
Replace the nasal mask with a ResMed full face mask if the leaks persist.

The AHI can be interpreted correctly when the leaks have been corrected.

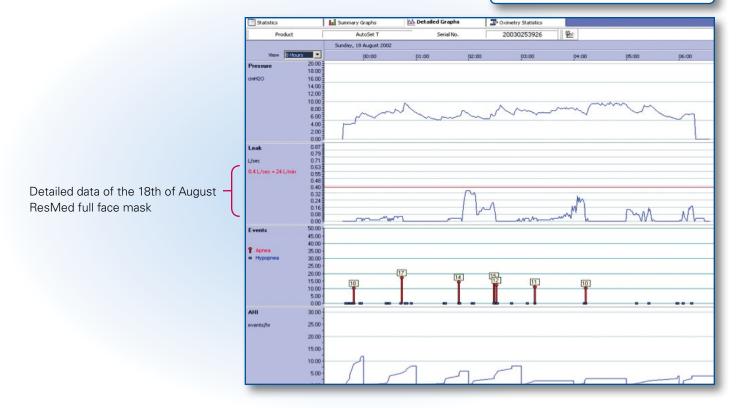
A substantial improvement in the AHI can be expected, given the initially high unknown apnea index. The S9 doesn't increase the pressure after this type of apnea. If these unknown apneas are actually obstructive apneas, they will be treated as such by the S9.

The high level of leaks (> 24 L/min) and their characteristic plateau shape (steep rise, flattening off then returning to the base line) indicate the presence of significant and variable leaks, most likely mouth leaks.

# Case Study 1: Example



# Case Study 1: Example



# **Case Study 2:**

Low therapy usage— Increase humidification or introduce ResMed ClimateLine<sup>™</sup>

The patient has recently been given an S9 AutoSet, but doesn't use it very often. The patient also says that he feels very thirsty when he wakes up each morning.

The numbers 1–4 (below) show the recommended order in which the data should be analyzed.

- 1 The average usage was low (1 hrs 32 min).
- 2 The unintentional leaks are under control:

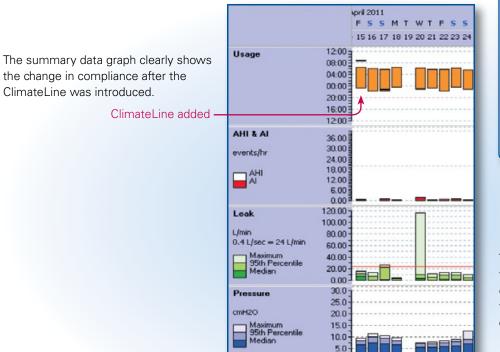
4

- 95th percentile leak < 24 L/min</li>
- Median leak = 0.0L/min.
- 3 The AHI is high, with a value of > 5.
- **4** The therapy pressure at the 95th percentile is 7.8 cm H<sub>2</sub>O with a maximum pressure setting of 20 cm H<sub>2</sub>O.

#### **Patient Profile** Patient Information Mr AutoSet EPR 3 S9 AutoSet Patient Name: Patient ID: Centrals Date of Birth: Age: Gender: Male Statistics Serial No.: 22101156666 Product: S9 AutoSet 3/28/2011 - 4/12/2011 **Device Settings** Maximum Pressure: 20.0 Therapy Mode: AutoSet Minimum Pressure: 7.0 cmH2O cmH2O Usage Used Days >= 4 hrs : 2 Used Days < 4 hrs : 9 % Used Days >= 4 hrs : 12 Days not used: 5 Total days: 16 Median daily usage: 1:43 Total hours used: 24:45 Average daily usage: 1:32 Leak - L/min Median: 0.0 95th Percentile: 3.6 Maximum: 12.0 AHI & AI - Events/hr Apnea index: 21.4 AHI: 21.4 Obstructive: 1.1 Central: 10.0 Unknown: 0.0 Hypopnea index: 0.0 Pressure - cmH2O Median: 7.1 95th Percentile: 7.8 Maximum: 8.1

In light of the patient's discomfort, a ResMed Climatel ine was added and the device settings were not changed.

#### RESMED



# Case Study 2:

# Suggested Solution

Add a ClimateLine to make therapy more comfortable.

**Result:** Adding a ClimateLine led to a significant increase in compliance. The patient finds therapy more comfortable and has increased utilization.

The statistics obtained after the ClimateLine was introduced enabled the increase in compliance to be quantified (4 hours 26 min instead of 1 hrs 32 previously).

## Case Study 3: High AHI–suspected CSR

# Patient treated on S9 AutoSet with a high AHI.

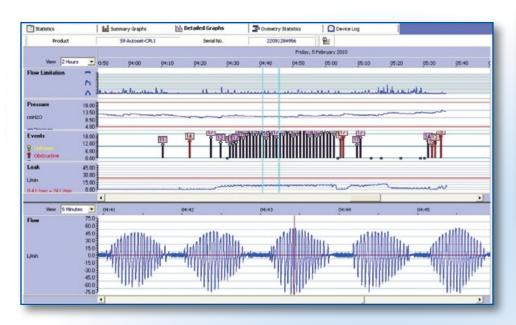
The numbers 1–4 (below) show the recommended order in which the data should be analyzed.

We can observe:

- Good therapy compliance: Usage of 6 hours 50 min per day.
- 2 A high CAI of 6.2, giving a total AI of 11.4.
- 3 Leaks are under control (95th percentile leak: 9.6 L/min).
- Pressure at the 95th percentile is
   13.8 cm H<sub>2</sub>O with a maximum
   pressure setting of 19.6 cm H<sub>2</sub>O.

<b>Statistics</b>		In Summary Graphs	Del	ailed Graphs	Oxim	netry Statistics	Device Log
Viewing Range	Custom	_ or	02/02/2010	▼ to 04/02/	2010	•	
Product		59 Autoset-CPL1		Serial No.	2209	1284956	
Device Settings		Therapy Mode:	AutoSet	Minimum Pressure:	4.0 cr	mH2O	
				Maximum Pressure:	20.0 cr	mH2O	
				EPR:	Off		
				EPR Level:	0.0 cr	mH2O	
Usage		Total hours used:	20:32	Used Days >= 4 hrs	3	days	
		(hrs:min)		Used Days < 4 hrs	0	days	
		Median daily usage:	7:03	Days not used:	0	days	
		(hrs/day of used days)		Total days:	3	days	
		Average daily usage: (total hrs/total days)	6:50	% Used Days >= 4 hr:	s 100	1%	
AHI & AI		Apnea index:	9.5	Hypopnea index:	1.9	AHI:	11.4
events/hour		Obstructive:	3.2				
		Central:	6.2				
		Unknown:	0.0				
Leak L/min		Median:	2.4	95th Percentile:	9.6	Maximum:	24.0
Pressure cmH2O		Median:	10.2	95th Percentile:	13.8	Maximum:	19.6

In this example, the patient's consistently high AHI warrants concerns of efficacy and a look at the detailed data.



In ResScan, you can display the detailed curves side by side with two time scales, giving a better picture of how the patient is being treated. In this example:

- Pressure, unintentional leak, flow limitation and events graphs are displayed with a 2-hour time scale.
- The flow curve is displayed with a 5-minute time scale.

# **Case Study 3**:

## Suggested Solution

**Perform a sleep study** to check for Cheyne–Stokes respiration (CSR).

# **Consider using an S9 VPAP Adapt** if CSR is confirmed.

**Result:** The sleep study confirmed the presence of CSR. The patient's AHI normalized with the S9 VPAP Adapt.

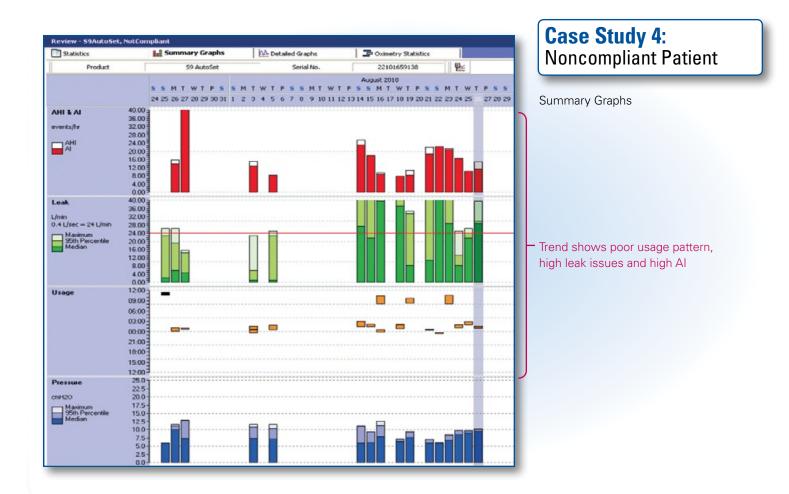
To find out more, we have to look at the detailed data, and in particular the 7-day flow curve for each session.

During this night of treatment, we can observe:

- Numerous central apneas, particularly during the 2nd part of the night
- A flow curve pattern indicative of Cheyne–Stokes respiration

Case Study 4: Noncompliant Pa	itient	
	_	Low Usage
Review - 59 VPAP Auto,	VAUTO	Detailed Graphs 2 Oximetry Statistics 2 De
Viewing Range	lonths 💌 or	11/23/2010 💌 to 2/21/2011 💌
Product	S9 VPAP Auto	Serial No. 22102499692
Device Settings	Therapy Mode:	VAUTO Min EPAP: 4.0 cmH2O Max IPAP: 20.0 cmH2O Pressure Support: 4.0 cmH2O
Usage	Total hours used: (hrs:min) Median daily usage:	118:22     Used Days >= 4 hrs     18 days       Used Days < 4 hrs
	(hrs/day of used days) Average daily usage: (total hrs/total days)	Total days:         91 days           1:18         % Used Days >= 4 hrs         19 %

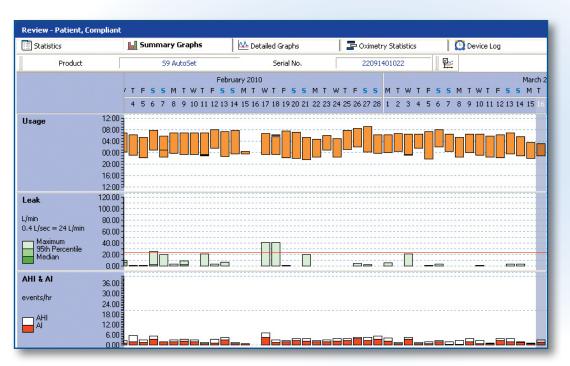
**Case Studies** 



<b>Case Study</b> Compliant Pa							
			(			High Usag	е
Review - Patient, Compliant							
Statistics	Summary Graphs	Del	tailed Graphs	1	📮 Oxime	etry Statistics	Device Log
Viewing Range	Days 🔹 or	2/ 3/2010	🗾 to	3/ 4/20	10	~	
Product	S9 AutoSet	2	Serial No.		22091	401022	
Device Settings	Therapy Mode:	AutoSet	Minimum Presso Maximum Press		4.0 cm 20.0 cm		
			EPR Level:		2.0 cm	H2O	
Usage	Total hours used: (hrs:min)	199:36	Used Days >≕ Used Days < ♦			days days	
	Median daily usage: (hrs/day of used days)	7:02	Days not used: Total days:			days days	
	Average daily usage: (total hrs/total days)	6:39	% Used Days :	= 4 hrs	93		
AHI & AI	Apnea index:	2.2	Hypopnea inde	x:	1.2	AHI:	3.4
events/hour	Obstructive:	1.9	1007223				
	Central:	0.2					
	Unknown:	0.0					
L <b>eak</b> L/min	Median:	0.0	95th Percentile	:	0.0	Maximum:	2.4
Pressure cmH2O	Median:	12.2	95th Percentile		18.3	Maximum:	19.7

# Case Study 5: Compliant Patient

Trend shows good usage, few leak issues and low AHI



## **Case Study 6:** Compliant patient but having issues

Patient presently on VPAP III S mode, IPAP 24, EPEP 20. Patient struggling with therapy due to high pressure, leak issues and complaints of high respiratory rate. AHI is controlled but feels like breathing on the device is very hard work. However, patient is still wearing it almost 6 hours per night.

Drowser	× Review - Blow, Joe					ResMed
Data	Statistics	Summary Graphs	1/ 1/2011	tailed Graphs 2/28/2011	etry Statistics OP Device Log	l
	Product	VPAP III		Serial No. 00000000	0040248514	
	Device Settings	Therapy Mode:	SPONT	Expiration Pressure: 20.0 o Inspiration Pressure: 24.0 o		
	IPAP onH20	Mediana		95th Percentile:	Maximum:	
Legend	Usage V	Total hours used: (hrs:min) Median daily usage: (hrs/day of used days) Average daily usage: (total hrs/hotal days)	359:58 5:58 6:06	Used Days < 4 hrs 0 Days not used: 0 Total days: 55	days days days days %	
A Detailed Data Sumary and Detailed Data FI Co. oct used Reports	AHI L AI events/hour	Apnea index:	0.4	Hypopnea index: 3.1	AHE: 3.5 % Time in Aprea: 0.1	
	Leak Unin	Median:	9.6	95th Percentile: 27.6	Maximum: 40.8	
	Respiratory Rate breaths/min	Median: % Spontaneous triggered breaths:	25	95th Percentile: 35.	Maximum: 42	

Leak issues

	Review - Blow, Joe						Rest
	Statistics	Summary Graphs	AA De	tailed Graphs	Doins Coarse	etry Statistics	Device Log
	Viewing Range Custom	· or	5/21/2011	• to 5/22/20	11	*	
	Product	VPAP Adapt (59)		Serial No.	22111	421077	
20	Device Settings	Therapy Mode:	ASV	EPAP:	8.0 cm	H20	
10				Max P5:	15.0 cm	1.0.2	
08				Min PS:	3.0 cm	H20	
06	IPAP	Median:	12.4	95th Percentile:	14.8	Maximum:	17.5
04	cmH2O						
02	Usage	Total hours used: (hrs:min)	13:05	Used Days >= 4 hrs		days	
rγ		Median daily usage:	6:32	Used Days < 4 hrs Days not used:		days days	
27		(hrs/day of used days)		Total days:	2	days	AHI well
Data		Average daily usage: (total hrs/total days)	6:32	% Used Days >= 4 hrs	100	76	controlled
Data	AHI & AI	Aprea index:	0.0	Hyprones index:	0.1	AHI:	0.1
and Detailed Data	events/hour			78952303793540		% Time in Apres	8:
	Leak	Medan:	3.6	99th Percentile:	24.6	Maximum:	30.0

## **Case Study 7:** Patient placed on S9 VPAP Adapt

Due to patient complaints, patient underwent several PSGs which revealed central apneas. Titrated on S9 VPAP Adapt, patient was sent home on it. Patient immediately felt a difference. He stated it was more comfortable and he could sleep more easily. Wore device longer (30 mins) and noticed decrease in pressure from 24/20 to Ipap of 14.8. Resp rate changed from 35 to 20.

This patient had been on the Vpap III for years. Always struggled but stuck with it. Complained that he could only tolerate the device for about 3-4 hours per session, then would have to take the mask off to "take a break." Could not tolerate the high pressures.

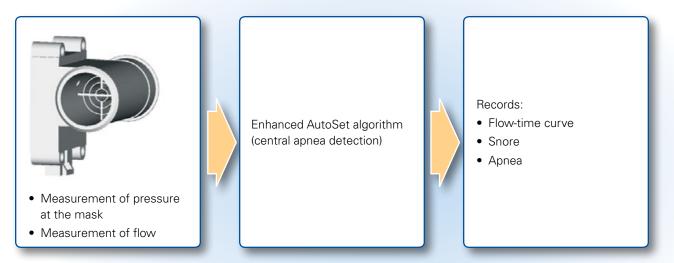
In previous sleep studies he ended up on 25/20, and had many centrals in the lab study.

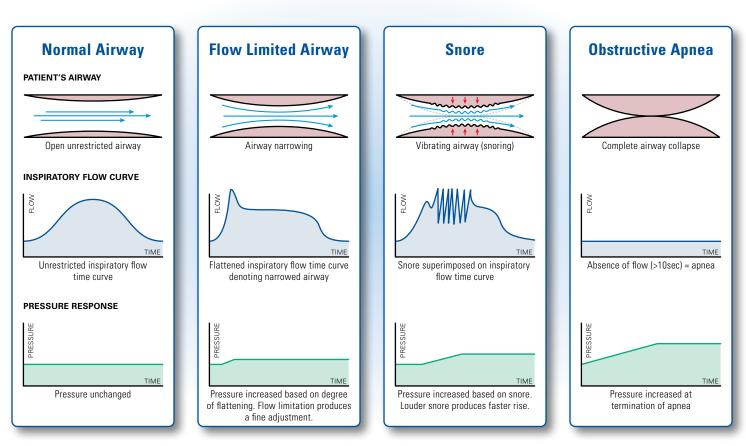
In his Adapt study, he went to sleep on the device with a Quattro<sup>™</sup> FX within 20 mins. Slept soundly all night; had no centrals at all. After the EEP was increased to 8 cm, patient had no events or arousals. Got up wanting the device to be set up that day. He remarked he had not slept that well for a long time. Patient was set up a week later on the device.

# Terminology & Definitions

### **Therapy Device Mechanics (S9)**

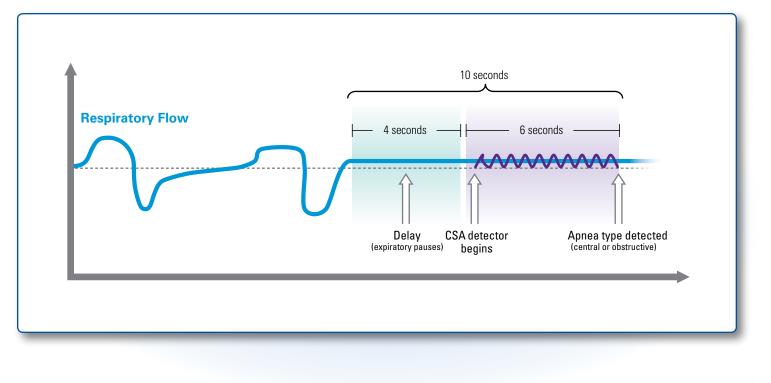
Sensors in Therapy Device



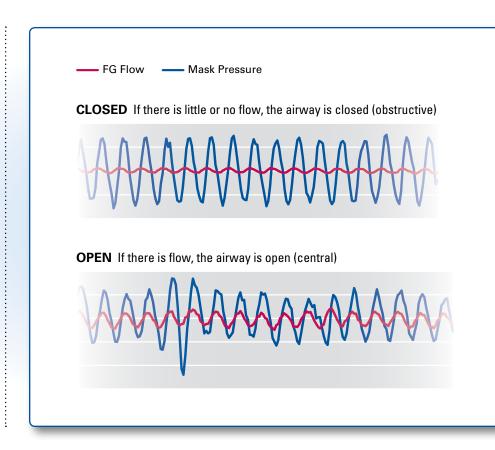


### **Flow Diagram**

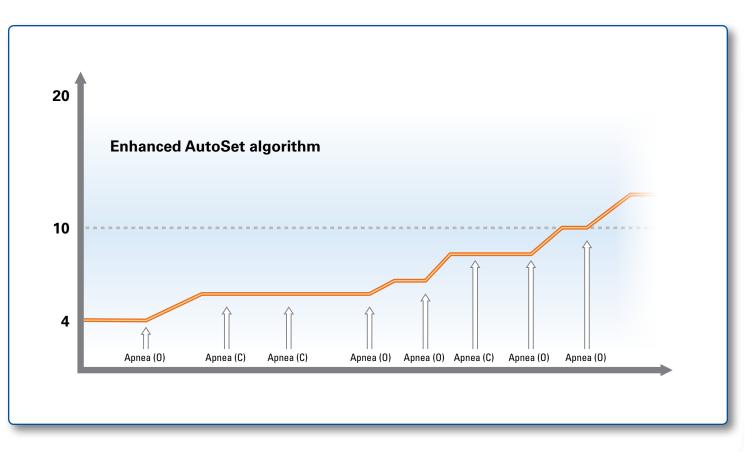
### **CSA Detector**—Forced Oscillation Technique



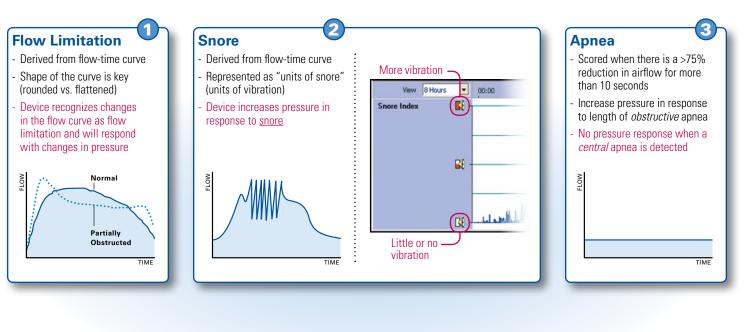
### **CSA Detector**



### CSA Detector—AutoSet Response



### **Three Lines of Defense**



### Glossary

#### Apnea

The temporary absence or cessation of breathing. An apnea is scored when there is reduction in breathing by 75% of the baseline breathing for at least 10 seconds. ResScan shows three types of apneas:

#### **Central Apnea**

An apnea during which the upper airway remains open.

#### **Obstructive Apnea**

An apnea during which there is a physical closing of the upper airway.

#### Unknown Apnea

An apnea during which a leak higher than 30 L/min occurs, precluding accurate determination of whether the apnea is obstructive or central.

#### **Apnea Indices**

For all indices, the value shown for Statistics is the total number of events divided by the Daily Usage.

#### AHI (Apnea-Hypopnea Index)

The total number of events is calculated by adding the number of apneas and hypopneas events. For the AHI graph, the AHI count is incremented whenever an event occurs and reset every hour.

#### Al: Apnea Index

HI: Hypopnea Index

CAI: Central Apnea Index

**OAI: Obstructive Apnea Index** 

UAI: Unknown Apnea Index

#### Average

A calculated value of a set of numbers computed by adding the total number of values and dividing by the number of values. Average for usage (therapy) hours is calculated over total calendar days.

#### **Daily Usage**

Daily Usage is the total usage in a single session (a session starts at midday and finishes 24 hours later).

#### Average Daily Usage

Average daily usage is the result of the sum of Daily Usage divided by Used Days, over a selected time period.

#### Median

The middle number in a sorted list of numbers. Half the numbers in the list are less, and half the numbers are greater (Example: 3, 3, 4, 5, 5, 5, 6, 9, 12, 23, 48: median = 5). Median for usage (therapy) hours is calculated over days used.

#### **Median Daily Usage**

The middle value for daily usage, where values for Daily Usage are listed from low to high, over a selected time period. While a few exceptionally high or low values can have a significant influence on an average measure, the median is typically more reflective of the true central tendency.

#### Event

The occurrence of an apnea or a hypopnea. Events are recorded as they occur. The maximum number of events stored per session is 500. After 500th event, 501 replaces 500, 502 replaces 501, etc.

#### Flow

An estimate of the patient's airflow during inspiration and expiration. It is derived by taking the total flow and removing the leak and mask vent flow components.

#### **Flow Limitation**

A measure of partial upper airway obstruction. This measure is based on the shape of the inspiratory flow-time curve. A flattening of the inspiratory flow-time curve suggests upper airway obstruction. A normal inspiratory curve would be round shaped.

### Glossary

#### Forced Oscillation Technique (FOT)

A technique that applies small oscillations in pressure (1 cm peak-to-peak) at 4Hz, and analyzes the pressure/flow response of this signal at the mask. FOT detects whether the airway is open or closed.

#### Hypopnea

An episode of shallow breathing during sleep. A hypopnea is scored when there is a reduction in breathing by 50% of baseline breathing associated with partial upper airway obstruction for at least 10 seconds.

#### Leak

An estimate of the total flow of air escaping due to mouth and mask leaks. It is derived by analyzing the inspiratory and expiratory airflows, together with the expected mask vent flows. High or changing leak rates may affect the accuracy of other measurements.

#### **Minute Ventilation**

The volume of air breathed in (or out) within any 60-second period.

#### 95th Percentile

The 95th percentile says that 95% of the time, the variable (eg, pressure) is at or below this amount. Just the same, during the remaining 5% of the time, the variable is above that amount.

#### Pulse Rate

The number of heartbeats in a 60-second time frame. The pulse rate is calculated by an attached oximeter.

#### **Snore Index**

A measure based on the amplitude of the vibrations generated by a patient's snoring.

#### SpO<sub>2</sub>

A measure of the saturation of blood hemoglobin with oxygen, expressed as a percentage. The oxygen saturation is calculated by an attached oximeter.

#### **Therapy Pressure**

In CPAP mode, therapy pressure is the set CPAP pressure. In AutoSet mode, therapy pressure is the pressure derived by the AutoSet algorithm.

#### **Tidal Volume**

The volume of air inspired or expired in one respiratory cycle (breath).

#### **Total Hours Used**

The total patient usage over a selected time range.

#### Usage

The length of time that a patient receives therapy from the device. The start and end times of the first ten individual periods of usage are available for each session when using ResScan.

#### Used Days

The total number of days during which daily usage exceeded the compliance threshold (X hours Y minutes).

#### % Used Days

Calculates the percentage of used days out of the total number of days selected.

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## **ResScan** Report Interpretation Guide

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